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# Ground-water Levels, Flow, and Specific Conductance in Unconsolidated Aquifers Near Lake Erie, Cleveland to Conneaut, Ohio, September 1984

Alban W. Cohen  
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GROUND-WATER LEVELS, FLOW, AND SPECIFIC CONDUCTANCE IN  
UNCONSOLIDATED AQUIFERS NEAR LAKE ERIE, CLEVELAND TO  
CONNEAUT, OHIO, SEPTEMBER 1984

By Alban W. Coen, III

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U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 89-4202



Columbus, Ohio  
1990

DEPARTMENT OF THE INTERIOR  
MANUEL LUJAN, JR., Secretary  
U.S. GEOLOGICAL SURVEY  
Dallas L. Peck, Director

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## CONVERSION FACTORS AND ABBREVIATIONS

For the convenience of readers who may prefer to use metric (International System) units rather than the inch-pound units used in this report, values may be converted by using the following factors:

<u>Multiply inch-pound unit</u>	<u>By</u>	<u>To obtain metric units</u>
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
gallon per minute (gal/min)	0.06309	liter per second (L/s)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

GROUND-WATER LEVELS, FLOW, AND SPECIFIC CONDUCTANCE IN  
UNCONSOLIDATED AQUIFERS NEAR LAKE ERIE, CLEVELAND TO CONNEAUT,  
OHIO, SEPTEMBER 1984

By Alban W. Coen, III

ABSTRACT

This report describes ground-water levels, flow, and specific conductance in aquifers along the southern shore of Lake Erie from Cleveland to Conneaut, Ohio. The data were collected in September 1984 as part of the U.S. Geological Survey's Northeast Glacial Buried Valley Regional Aquifer-System Analysis. The study area is about 60 miles long, extends inland from the lake about 10 miles, and encompasses parts of Cuyahoga, Lake, and Ashtabula Counties.

Water levels were measured in 202 existing wells, all of which were completed in the glacial deposits or at the contact with the underlying shale. Specific conductance was measured in 59 of the wells. Results of the survey are presented in table and map form.

Unconsolidated material throughout the area consists primarily of till, whereas the bedrock consists of Devonian shale. The till is composed chiefly of silt and clay with some sand and gravel, and is less than 50 feet thick in most areas. Some valleys are filled with as much as 200 feet of glacial till and outwash deposits that are mainly sand and gravel.

Ground-water levels in much of the area are within 20 feet of the land surface. Contours of ground-water levels resemble a subdued version of those of the land surface, which indicates that ground water generally flows from high areas to low areas following the land-surface gradient. Locally, ground water discharges into streams. Regionally, flow is towards the north-northwest, to Lake Erie.

Specific conductance ranged from 160 to 2,900  $\mu\text{S}/\text{cm}$  (microsiemens per centimeter at 25 degrees Celsius) with a median of 540  $\mu\text{S}/\text{cm}$ . Ground water with a specific conductance greater than 650  $\mu\text{S}/\text{cm}$  is localized, with no specific spatial pattern; possible sources of elevated specific conductance are road-deicing salt, leachate from landfills, natural brines associated with oil and gas drilling, and the upward leakage of saline water from bedrock.

## INTRODUCTION

The U.S. Geological Survey's Northeastern Glacial Buried Valley Regional Aquifer-System Analysis (RASA) project (Lyford and others, 1983) was established to study the hydrogeologic characteristics of unconsolidated glacial aquifers in the Northeastern United States. One aspect of this project is to determine water levels in unconsolidated aquifers along Lake Erie.

Lake Erie has great economic importance for millions of Americans and Canadians living along its shore. As the quality of the surface water flowing into the lake improves, increased interest is being focused on the effect of ground-water discharge directly to Lake Erie and to tributaries to Lake Erie. A major factor controlling the direction and rate of ground-water flow is the hydraulic gradient. Hydraulic gradient, the change in head per unit distance measured in the direction of steepest change, is determined by measuring water levels in wells in relation to a datum, usually sea level.

Specific conductance, the inverse of electrical resistivity, is a measure of the concentration of total dissolved solids in water. Specific conductance is described in terms of microsiemens per centimeter at 25 degrees Celsius and is abbreviated  $\mu\text{S}/\text{cm}$ . It can easily be measured in the field (Freeze and Cherry, 1979).

### Purpose and Scope

This report presents a regional overview of ground-water levels, flow, and specific conductance in aquifers underlying an area along Lake Erie. The study area extends from Cleveland to Conneaut, Ohio, and includes parts of Cuyahoga, Lake, and Ashtabula Counties. The area is about 60 mi (miles) long and 10 mi wide (fig. 1).

The report includes results of water-level measurements from 202 wells and specific-conductance values of water from 59 wells measured in September 1984. Detailed description of the geology of the area was outside the scope of the study and was not attempted.

### Hydrogeologic Setting

The study area includes two contrasting physiographic divisions--the lake plains and glaciated plateau (White, 1982, p. 7). Lake plains (fig. 2), underlain by soft Devonian shales that dip slightly to the south, are present in a band up to 7 mi wide along Lake Erie. The plain starts at an elevation of about 600 ft (feet) above sea level (about 30 ft higher than the water level of Lake Erie) and rises gently to about 750 ft in the south. Except for ancient postglacial sandy beach ridges, the plain is flat and poorly drained (White, 1982).

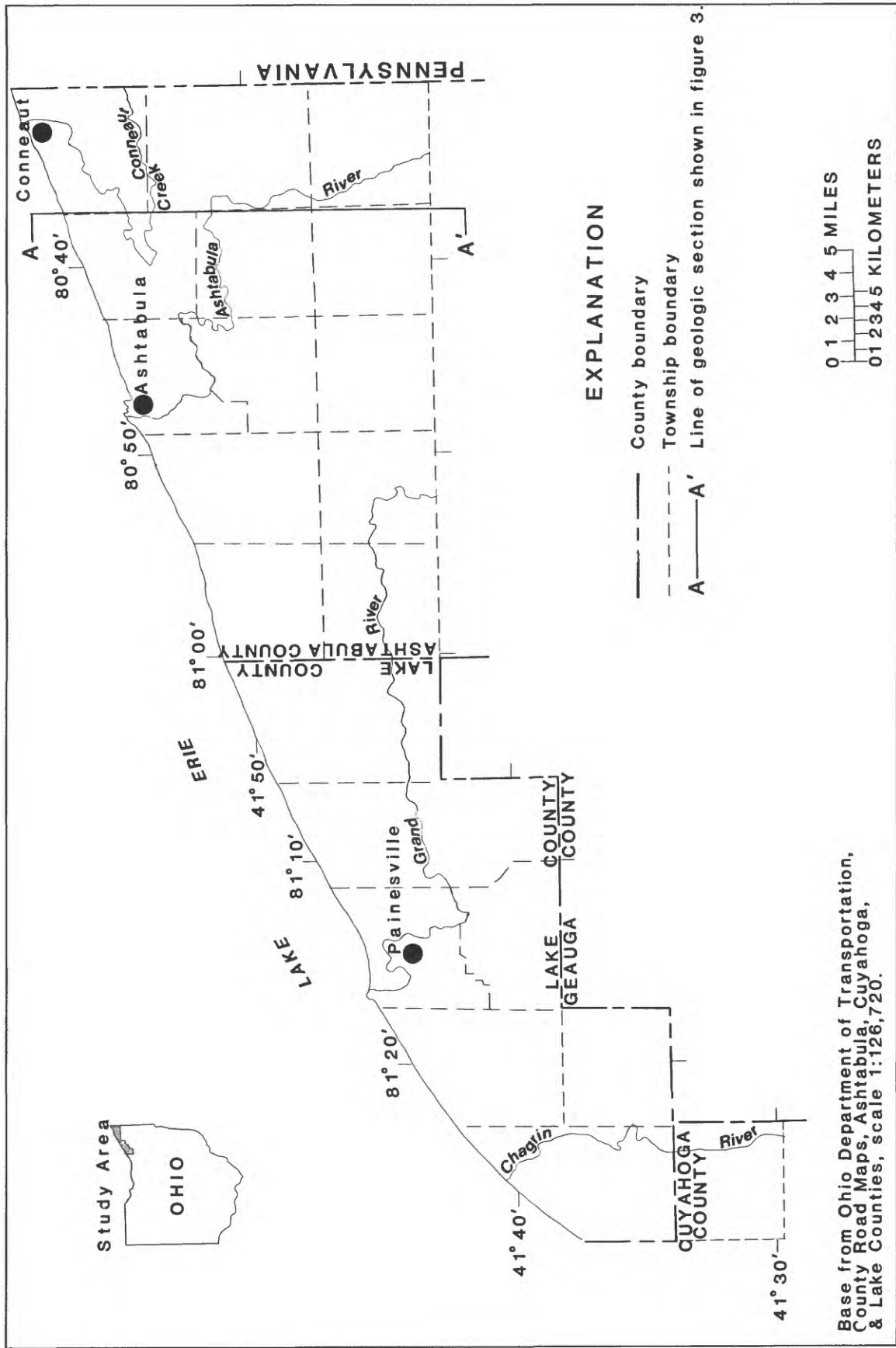


Figure 1.--Study area.



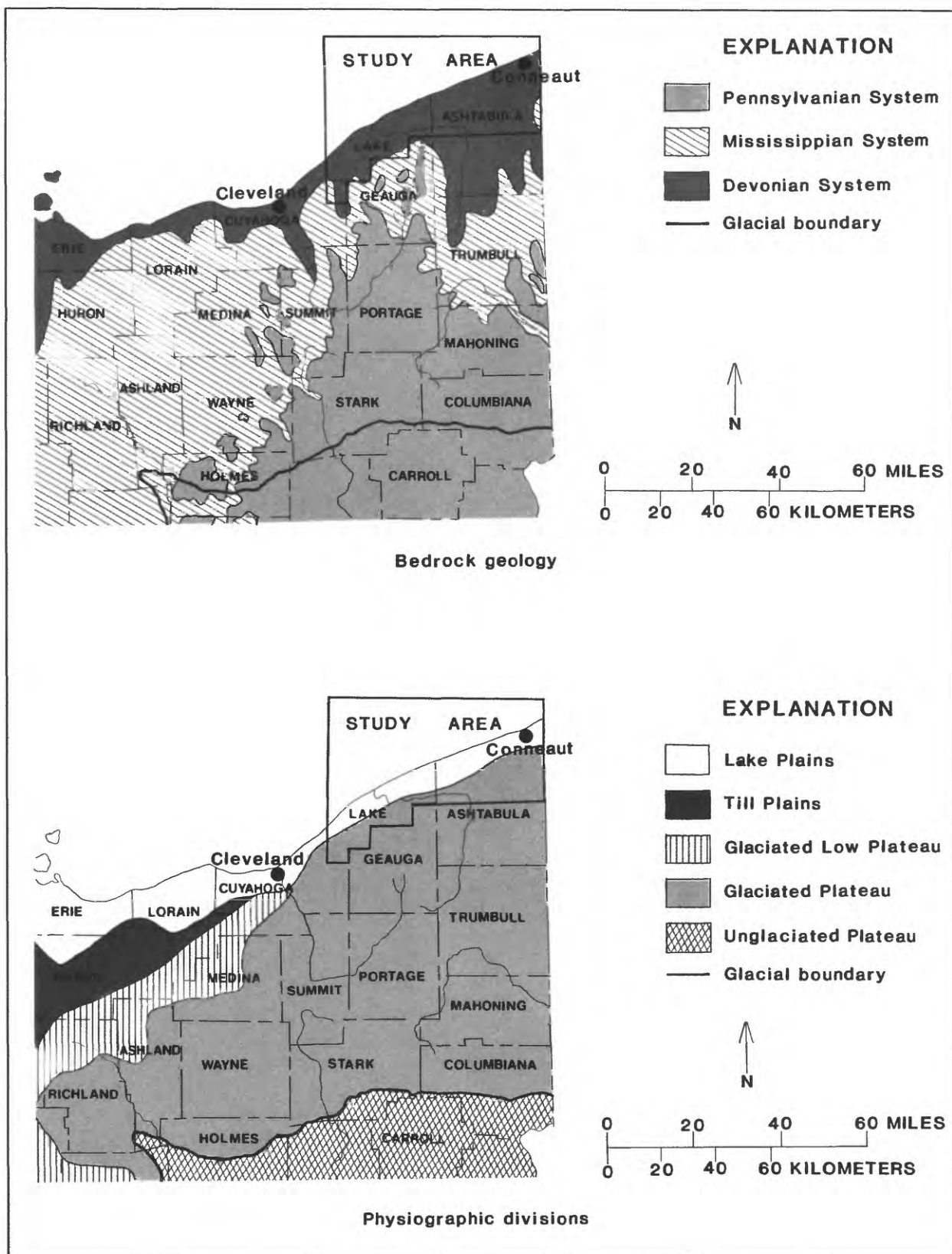


Figure 2.—Bedrock geology and physiographic divisions of northeastern Ohio (from White, 1982, figure 3 and 4).

South of the lake plain, the land slopes upward to the glaciated plateau (fig. 2), which is about 900 to 1,200 ft above sea level. The plateau is underlain mostly by shales of Devonian age. A small part of the plateau in the study area is capped by sandstone and conglomerates of Mississippian age and is cut by deep river valleys. The shales are exposed in some of the valley walls. The bedrock dips slightly to the south, away from Lake Erie. Representative geologic sections through the area are shown in figures 3 and 4.

Several times during the last 2 million years, glaciers advanced from the north, covered the area, and retreated. The glacial activity rounded off hills and deepened some of the valleys. Clay, silt, sand, and gravel were deposited as the glaciers advanced and retreated. Most of the area was covered with one or more layers of clay, silt, and sandy till, which, in total, usually are less than 50 ft thick. Interspersed in the till are lenses consisting almost entirely of sand and gravel. In parts of the area, a layer of "blue" clay separates an upper and lower layer in the glacial sediments.

During glaciation, many streams flowed north, toward the glaciers. They were dammed by the ice, which created proglacial lakes between the ice front and the uplands to the south. In valleys inundated by these lakes, sediment-laden meltwaters deposited clay and silt interlayered with sand and gravel. Some of the buried-valley deposits exceed 200 ft in thickness and consist predominantly of lake clays.

As the last glacier retreated about 15,000 years ago, the area began to rise slowly as it rebounded from the weight of the diminishing ice. Lake Erie began draining to the east and, as the level of the lake dropped, wave action cut a series of terraces in the shoreline, and sandy beach ridges were deposited on each terrace (fig. 4).

The courses of north-flowing streams in the area commonly made right-angle turns at the beach ridges, flowed west to breaches in the beach ridges, and then continued on to Lake Erie. As the lake level (stream-base level) dropped, the streams cut channels through the glacial sediments and into the shale bedrock. Today, major streams such as the Grand and Ashtabula Rivers are in deep bedrock gorges cut through the plateau above the lake plains.

Wells drilled in the till generally yield less than 3 gal/min (gallons per minute) (Crowell, 1979; Hartzell, 1978; and Schmidt, 1979). These wells commonly are completed in gravel or broken rock at the contact between the till and underlying shales. Many of the wells in the lake plains were hand dug and are completed in the till. Some of these wells are more than 100 years old. Typically, they are about 4 ft in diameter and less than 20 ft deep. Yield is usually enough for domestic use only.

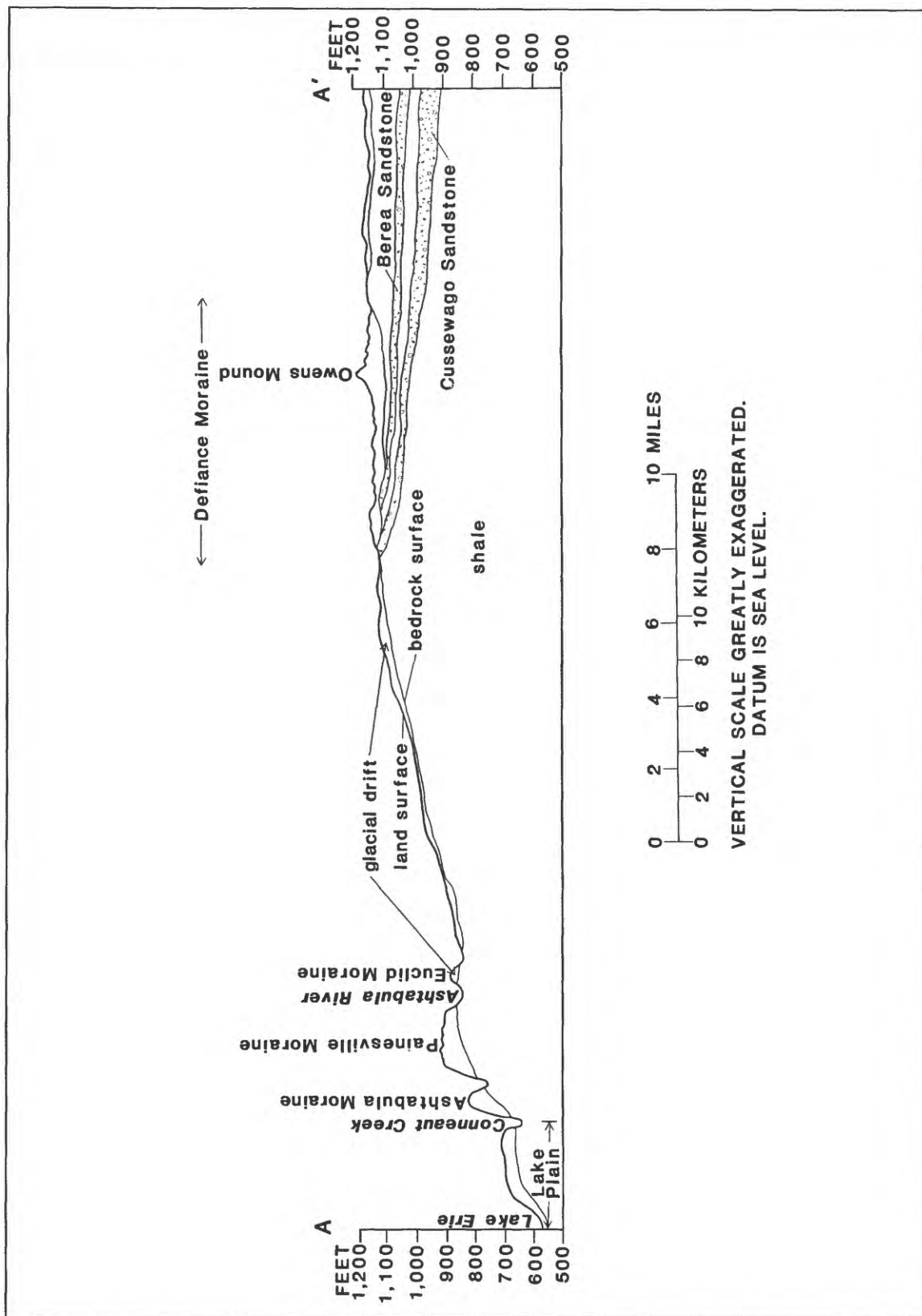


Figure 3.--North-south section across Ashtabula County (modified from White and Totten, 1979; location of section A-A' is shown in figure 1).

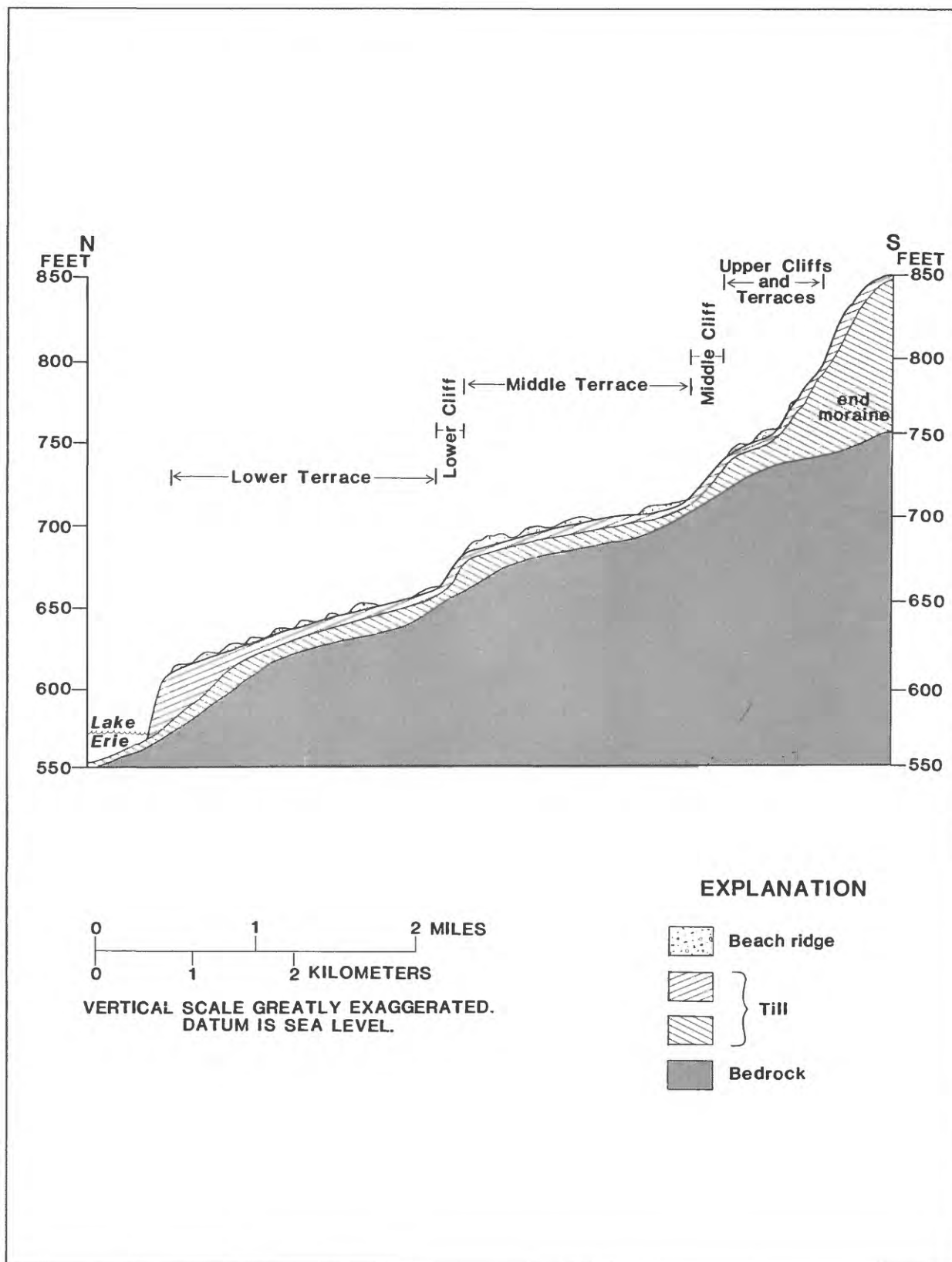


Figure 4.--Generalized geologic section along Lake Erie shoreline in Lake and Ashtabula Counties showing unconsolidated deposits (from White, 1982).

Outwash and ice-laid deposits in the buried valleys yield more water to wells than do till deposits. Some wells produce up to 50 gal/min (Crowell, 1979; Hartzell, 1978; and Schmidt, 1979). Because the sand and gravels are not always continuous deposits, the yield to wells can differ greatly within a small area. Some lacustrine deposits in the dammed valleys yield very little water to wells.

The unconsolidated deposits are treated as one aquifer for the purpose of this regional study. Different types of deposits have different hydraulic properties. Many of the sand and gravel lenses and layers are discontinuous and difficult to correlate from one well to another. However, the deposits seem to be hydraulically connected, as the measured ground-water levels are locally uniform.

The ground-water system is confined by clays and tills in many areas, and some wells flow; however, the system is unconfined or only semiconfined in other areas. The beach ridges are sandy and permeable. The clays and tills are poorly permeable. A detailed examination of the properties of the unconsolidated deposits was beyond the scope of this study.

#### Methods of Study

Approximately 300 well logs were selected from the files of the Ohio Department of Natural Resources, Division of Water; almost all are for domestic wells. An effort was made to select wells that are completed in unconsolidated sediments (usually sand and gravel). Many of the logs do not indicate the level where water was first encountered. Some logs indicate water in the gravel or in broken or weathered rock just above the shale. A few logs indicate that, because of low yields in the unconsolidated deposits, the wells were drilled into the shale to provide a reservoir to store water for the pump. Many of the wells were selected if it could be reasonably assumed that they were completed in glacial sediments. No wells drilled into sandstone were selected.

During the periods September 10-14 and September 18-19, 1984, 202 wells were located (fig. 5), and water levels were measured (table 1, at back of report). In some cases, the wells for which logs were available could not be located or measured, so nearby wells with similar characteristics were measured if possible.

Some information gathered from well owners consists of approximations (for example, many well depths were estimated). Land-surface elevations at the wells were estimated from U.S. Geological Survey 7.5-minute topographic maps in the field, and are believed to be accurate to within 5 ft. Depths to water were measured with a steel tape with an accuracy of 0.01 ft.



Latitude and longitude for each well were digitized from U.S. Geological Survey topographic maps. The water-level altitude was calculated by subtracting the depth to water from the land-surface elevation after correcting for the difference between the measurement point and the land surface. All information was entered into the U.S. Geological Survey's Ground-Water Site Inventory (GWSI) computer data base (Mercer and Morgan, 1982).

Specific conductance of water was measured with a portable meter in the field at 59 of the wells where their diameter and plumbing permitted access. Many of the measurements were made at dug wells. It was not possible to pump all the wells before measuring. Because most wells were domestic wells that were used regularly, all measurements were considered to be representative of local ground water even if pumping before measurement was not possible.

#### GROUND-WATER LEVELS AND FLOW

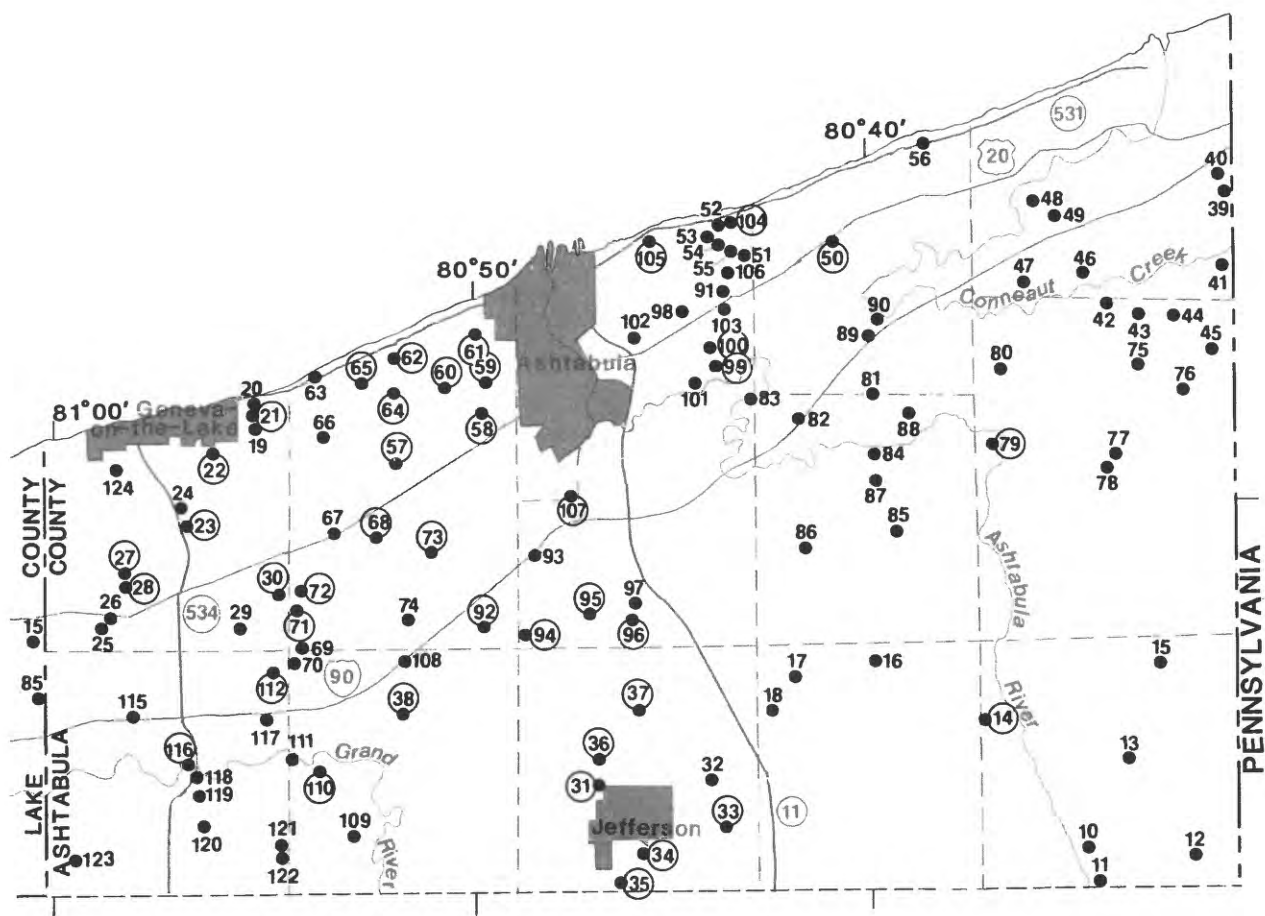
The altitudes of the ground-water levels in the study area are shown in figure 6. The contours imply a gradual northwestward slope of the water table toward Lake Erie. The slope is more gentle and consistent in the lake plains than in the rest of the area. Along the lake plains, ground water is encountered usually within 10 to 20 ft of the ground surface. Farther south, where the land rises to the Allegheny Plateau, the depth to water ranges from 5 to greater than 50 ft.

Locally, ground water discharges to streams, and the water table slopes toward streams. This is shown in places where several wells were measured near streams, and by the manner in which the ground-water levels follow the land surface on the lake plains.

In most of the study area, the ground-water levels resemble a subdued version of the land surface; thus, ground-water flow usually follows the land-surface gradient. At a few sites on the lake plains and glaciated plateau, water levels in adjacent shallow and deep wells indicate a vertical hydraulic gradient. The gradient was downward on the glaciated plateau (a recharge area) and upward near the Lake (a discharge area).

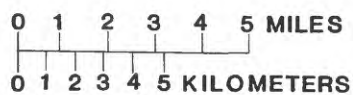
Water enters the ground-water system in the study area as underflow from south of the study area (upgradient) and as recharge from precipitation, mainly on the beach ridges. Water leaves the system as discharge to streams and Lake Erie, evapotranspiration, and withdrawal by pumping.





### EXPLANATION

- 40 MEASURED WELL AND NUMBER--Water-level measurement only.
- 38 MEASURED WELL AND NUMBER--Water-level and specific-conductance measurements.





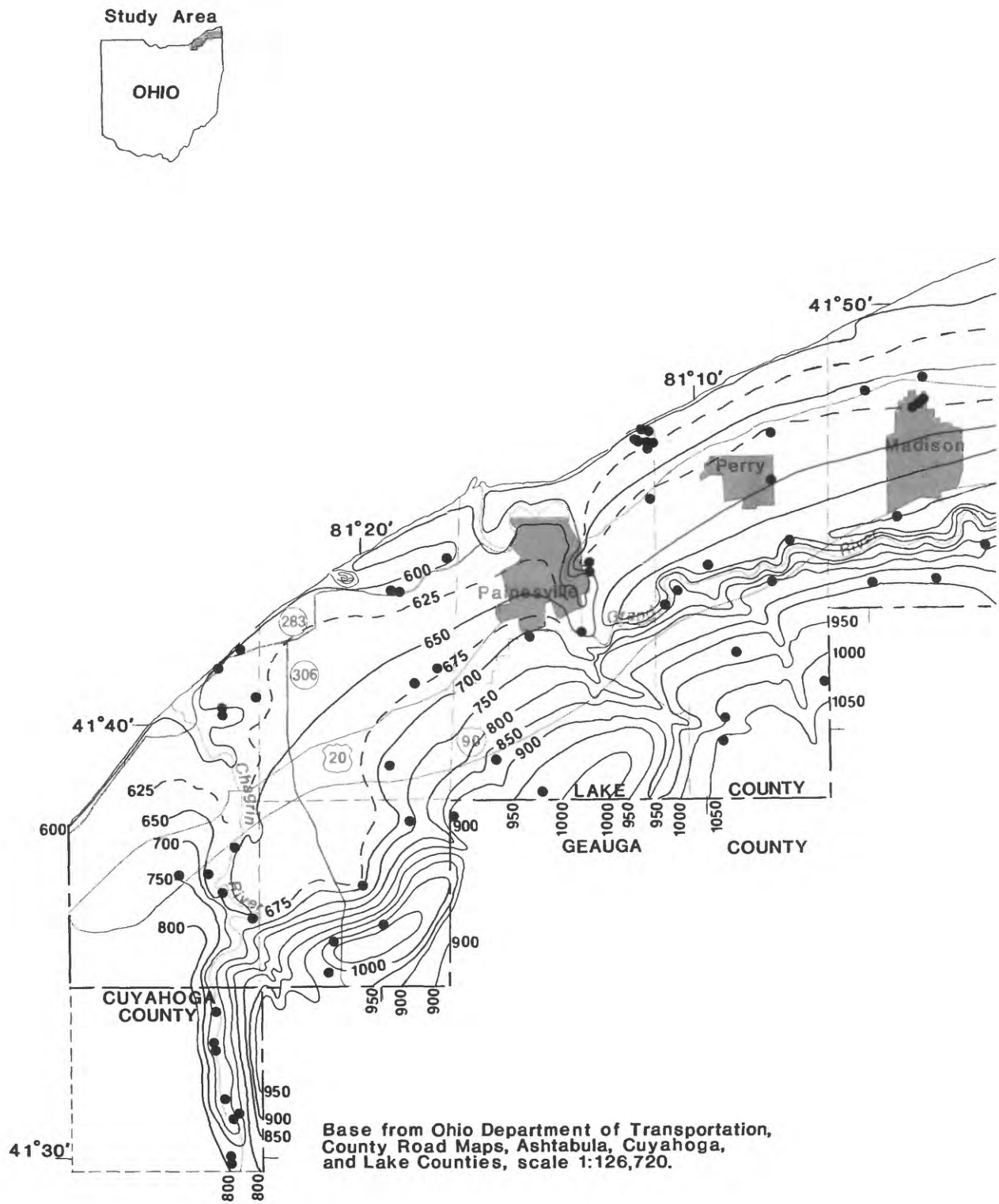
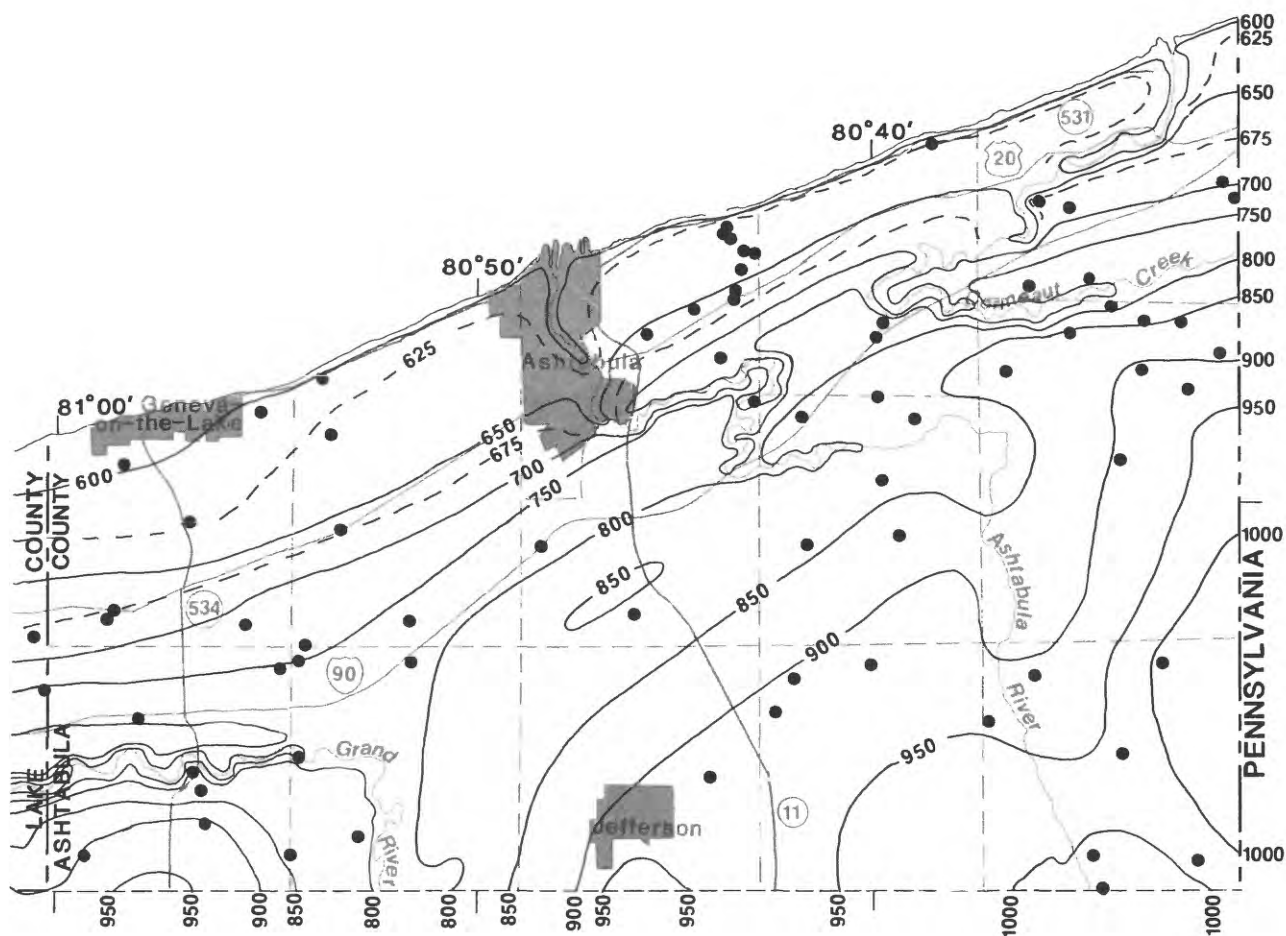
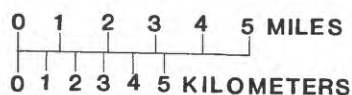


Figure 6.-Level of ground water in unconsolidated deprecits in the study area.



### EXPLANATION

- 600 — WATER-LEVEL CONTOUR—Shows altitude of ground-water level, in feet above sea level; interval is 50 feet.
- 625 -- INFERRED WATER-LEVEL CONTOUR—Shows altitude of ground-water level, in feet above sea level; interval is 50 feet.
- MEASURED WELL—Value is altitude of water level, in feet above sea level.



Possible routes of ground-water flow to Lake Erie include--

1. Discharge to streams. Many gaining streams in the study area flow directly into Lake Erie.
2. Seepage into Lake Erie from beach cliffs. Bedrock is below lake level along the shore at most of the study area, and the beach cliffs are composed of unconsolidated glacial deposits. Water flows through the sediments above bedrock or above an impermeable layer in the till into Lake Erie.

The effect of the deep east-west river valleys (the Grand River Valley, for example) on the ground water could not be fully determined by this reconnaissance study. Some seeps were seen in the till and shale cliffs along the rivers. These rivers (and many smaller streams) probably intercept ground water and hasten its flow to Lake Erie.

The beach ridges, which rise above the lake plains, are major areas of recharge. Beach ridges have little effect on the regional flow patterns, although they add to the quantity of water in the system.

#### SPECIFIC CONDUCTANCE OF GROUND WATER

Specific conductance of water in 59 of the measured wells ranged from 200 to 2,900  $\mu\text{S}/\text{cm}$ ; the data are presented in figure 7 and table 1 (at back of report). Two-thirds of the values were less than 650  $\mu\text{S}/\text{cm}$ , and one-third exceeded 650  $\mu\text{S}/\text{cm}$ ; the median value was 540  $\mu\text{S}/\text{cm}$ . No spatial pattern of high (greater than 650  $\mu\text{S}/\text{cm}$ ) specific-conductance values was noted. Some high values were near potential problem areas, such as landfills. Others were on beach ridges, which may be easily contaminated by salting of major roads along the ridges. Some high values were in areas where residents tell of nearby oil and gas drilling and brine dumping. In addition, some high specific conductances could result from upward leakage of water from bedrock.

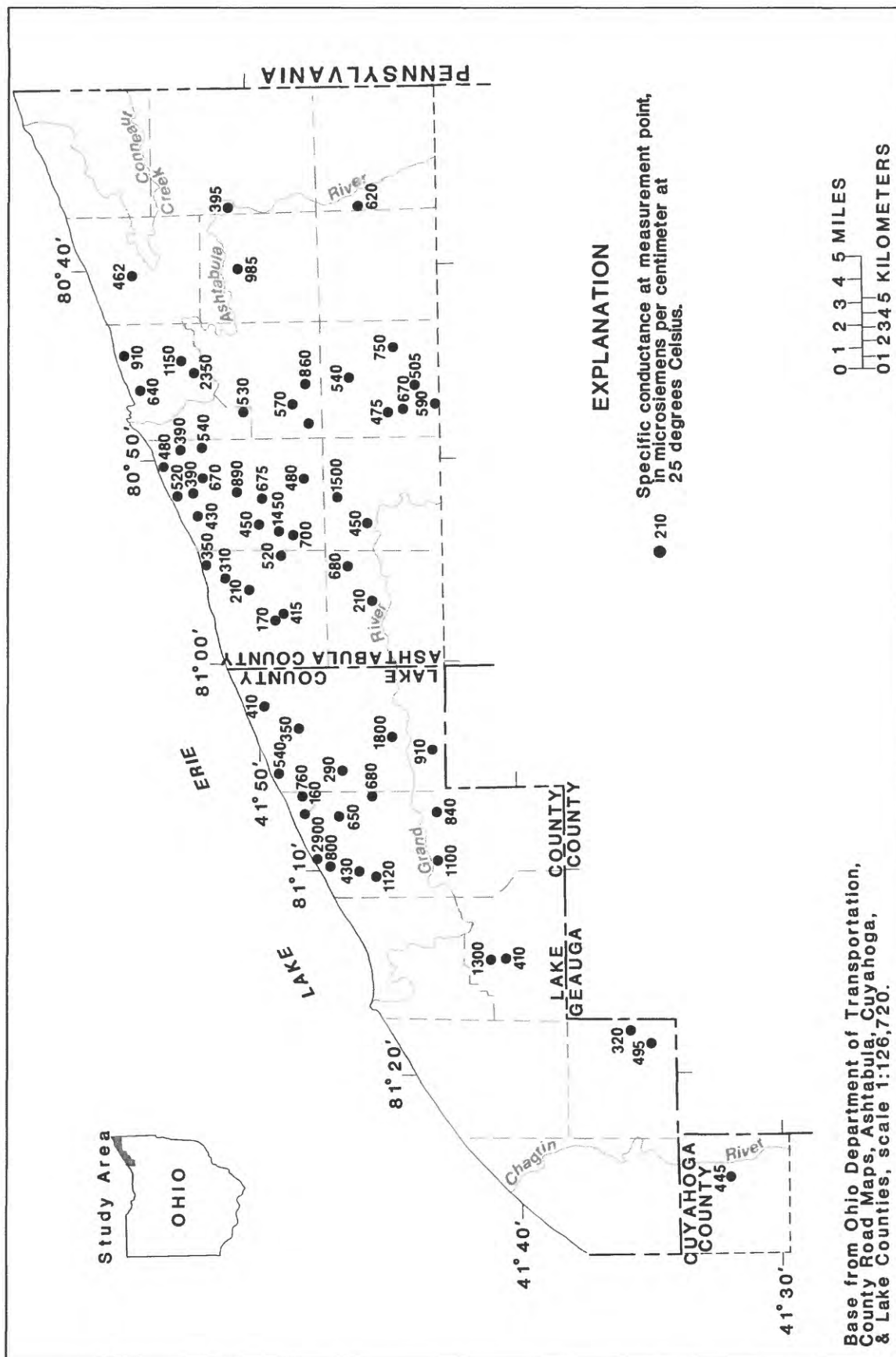


Figure 7.--Specific conductance of ground water in the study area.

## SUMMARY AND CONCLUSIONS

The ground-water levels determined as part of this study indicate that the hydraulic gradient and, hence, the direction of ground-water flow is to the north-northwest toward Lake Erie. Locally, the direction of ground-water flow follows the slope of the land surface; ground-water discharges into streams and rivers, which flow into Lake Erie. In the Lake Plains area, ground water is usually within 20 ft of the land surface. The shallowness of water levels in unconsolidated sediments indicates that recharge is rapid in areas such as the beach ridges, and that the sediments are susceptible to contamination. The susceptibility of parts of the aquifers to contamination and the regional flow of ground water toward Lake Erie can have a major effect on local water users and on Lake Erie itself.

Most of the specific-conductance values ranged from 200 to 650  $\mu\text{S}/\text{cm}$ , but about a third of them were higher. Values greater than 650  $\mu\text{S}/\text{cm}$  did not form an areal pattern that could be related to the geology or hydrology of the area; they most likely reflect increased concentrations of dissolved solids resulting from human activities.

Many thin, discontinuous sand and gravel deposits underlie the area, and information on their extent is sparse. Additional data on the extent and continuity of the glacial aquifers would be important in future assessments of the contribution of ground water to Lake Erie.

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Table 1.--Data for selected wells near Lake Erie, Cleveland to Conneaut, Ohio,  
September 1984

[ $\mu$ S/cm, microsiemens per centimeter at 25 degrees Celsius; S&G, well completed in sand and gravel; Sh, well completed as open hole in shale below screened sand-and-gravel interval. Dash indicates no data available. Water-use designations: D, domestic; U, unused; P, public supply; T, institution; C, commercial; S, stock; R, recreation; I, industrial; and Z, other.]

Local number		Location			Completed in:	Altitude of land surface (feet)	Date of measurement	Water level below land surface (feet)	Specific conductance (µS/cm)	Water use
AB-10	lat	414334	long	803427	S&G	1,022	09/10/84	2.35	--	D
AB-11	lat	414253	long	803415	Sh	1,031	09/10/84	7.01	--	D
AB-12	lat	414322	long	803159	Sh	1,010	09/10/84	18.90	--	D
AB-13	lat	414511	long	803348	S&G	995	09/10/84	5.80	--	U
AB-14	lat	414528	long	803658	Sh	962	09/10/84	10.42	620	D
AB-15	lat	414655	long	803258	Sh	1,021	09/10/84	10.68	--	D
AB-16	lat	414658	long	803937	Sh	928	09/10/84	12.55	--	D
AB-17	lat	414647	long	804138	S&G	909	09/10/84	5.29	--	D
AB-18	lat	414611	long	804204	Sh	910	09/10/84	5.01	--	D
AB-19	lat	415132	long	805431	S&G	610	09/10/84	1.90	--	D
AB-20	lat	415139	long	805432	S&G	580	09/10/84	6.41	--	D
AB-21	lat	415136	long	805432	S&G	610	09/10/84	.50	350	U
AB-22	lat	415032	long	805538	Sh	615	09/10/84	6.94	310	U
AB-23	lat	414930	long	805611	Sh	630	09/10/84	5.16	210	D
AB-24	lat	414933	long	805611	S&G	630	09/10/84	15.35	--	D
AB-25	lat	414801	long	805810	S&G	675	09/10/84	10.85	--	D
AB-26	lat	414759	long	805817	S&G	680	09/10/84	6.20	--	D
AB-27	lat	414811	long	805755	S&G	660	09/10/84	6.25	170	D
AB-28	lat	414821	long	805758	Sh	665	09/10/84	3.71	415	D
AB-29	lat	414747	long	805455	Sh	735	09/10/84	55.95	--	D
AB-30	lat	414820	long	805359	S&G	735	09/10/84	22.42	520	D
AB-31	lat	414511	long	804651	S&G	869	09/10/84	5.06	670	D
AB-32	lat	414457	long	804356	Sh	925	09/10/84	5.47	--	U
AB-33	lat	414420	long	804323	Sh	930	09/10/84	7.00	750	D
AB-34	lat	414348	long	804550	S&G	955	09/10/84	5.72	505	D
AB-35	lat	414302	long	804620	Sh	962	09/10/84	7.43	590	D
AB-36	lat	414518	long	804652	Sh	872	09/10/84	10.23	475	D
AB-37	lat	414608	long	804522	Sh	875	09/10/84	7.40	540	D
AB-38	lat	414620	long	805055	Sh	805	09/10/84	19.65	1,500	D
AB-39	lat	415526	long	803103	S&G	750	09/11/84	14.00	--	D
AB-40	lat	415545	long	803126	S&G	692	09/11/84	8.49	--	D
AB-41	lat	415401	long	803126	S&G	845	09/11/84	30.38	--	D
AB-42	lat	415327	long	803402	S&G	822	09/11/84	27.60	--	D
AB-43	lat	415306	long	803322	S&G	881	09/11/84	2.50	--	D
AB-44	lat	415312	long	803229	S&G	900	09/11/84	37.58	--	D
AB-45	lat	415245	long	803131	S&G	907	09/11/84	24.62	--	S
AB-46	lat	415358	long	803438	S&G	836	09/11/84	59.28	--	D
AB-47	lat	415351	long	803611	S&G	855	09/11/84	68.69	--	U
AB-48	lat	415518	long	803603	S&G	681	09/11/84	9.06	--	D
AB-49	lat	415508	long	803510	S&G	690	09/11/84	4.49	--	D
AB-50	lat	415427	long	804129	S&G	670	09/11/84	Spring	462	P
AB-51	lat	415429	long	804316	S&G	638	09/11/84	-.38	--	U
AB-52	lat	415437	long	804335	S&G	630	09/11/84	5.02	--	U
AB-53	lat	415438	long	804336	S&G	630	09/11/84	1.43	--	U
AB-54	lat	415443	long	804334	S&G	635	09/11/84	4.79	--	U



Table 1.--Data for selected wells near Lake Erie, Cleveland to Conneaut, Ohio,  
September 1984--Continued

Local number	Location			Completed in:	Altitude of land surface (feet)	Date of measurement	Water level below land surface (feet)	Specific conductance (µS/cm)	Water use	
AB-55	lat	415429	long	804319	S&G	638	09/11/84	1.72	--	U
AB-56	lat	415624	long	803847	S&G	645	09/11/84	10.29	--	R
AB-57	lat	415025	long	805135	Sh	652	09/11/84	9.00	890	D
AB-58	lat	415114	long	804958	S&G	650	09/11/84	8.54	540	D
AB-59	lat	415153	long	804949	S&G	633	09/11/84	5.63	390	D
AB-60	lat	415152	long	805108	S&G	630	09/11/84	1.40	670	D
AB-61	lat	415251	long	804955	S&G	635	09/11/84	5.48	480	D
AB-62	lat	415240	long	805143	S&G	626	09/11/84	2.75	520	U
AB-63	lat	415212	long	805340	S&G	615	09/11/84	3.05	--	D
AB-64	lat	415157	long	805151	S&G	631	09/11/84	3.70	390	D
AB-65	lat	415157	long	805256	S&G	625	09/11/84	.80	430	D
AB-66	lat	415115	long	805314	S&G	631	09/11/84	2.40	--	D
AB-67	lat	414924	long	805305	S&G	676	09/11/84	5.36	--	U
AB-68	lat	414918	long	805242	S&G	695	09/11/84	4.10	450	D
AB-69	lat	414721	long	805352	Sh	785	09/11/84	70.42	--	D
AB-70	lat	414715	long	805356	Sh	795	09/11/84	77.83	--	D
AB-71	lat	414806	long	805354	S&G	715	09/11/84	Flowing	700	D
AB-72	lat	414824	long	805344	S&G	745	09/11/84	18.34	1,450	D
AB-73	lat	414914	long	805042	S&G	755	09/11/84	26.53	675	D
AB-74	lat	414747	long	805103	S&G	834	09/11/84	72.00	--	D
AB-75	lat	415219	long	803323	S&G	915	09/12/84	12.00	--	R
AB-76	lat	415155	long	803134	Sh	951	09/12/84	5.42	--	U
AB-77	lat	415039	long	803355	S&G	912	09/12/84	2.60	--	T
AB-78	lat	415038	long	803356	S&G	912	09/12/84	11.18	--	T
AB-79	lat	415050	long	803653	Sh	840	09/12/84	6.68	395	S
AB-80	lat	415214	long	803659	S&G	890	09/12/84	14.62	--	U
AB-81	lat	415148	long	803923	S&G	858	09/12/84	42.85	--	D
AB-82	lat	415130	long	804112	S&G	862	09/12/84	43.67	--	U
AB-83	lat	415147	long	804232	S&G	711	09/12/84	13.73	--	D
AB-84	lat	415043	long	803931	S&G	840	09/12/84	15.75	--	Z
AB-85	lat	414925	long	803901	S&G	870	09/12/84	9.42	--	D
AB-86	lat	414909	long	804110	S&G	851	09/12/84	4.70	--	D
AB-87	lat	415014	long	803916	S&G	858	09/12/84	10.28	--	T
AB-88	lat	415129	long	803812	S&G	875	09/12/84	61.29	--	D
AB-89	lat	415257	long	804004	S&G	780	09/12/84	25.28	--	U
AB-90	lat	415317	long	803958	S&G	780	09/12/84	13.40	--	U
AB-91	lat	415345	long	804326	S&G	660	09/12/84	5.06	--	U
AB-92	lat	414745	long	804932	S&G	835	09/12/84	14.97	480	D
AB-93	lat	414907	long	804741	S&G	865	09/12/84	74.66	--	U
AB-94	lat	414738	long	804801	S&G	858	09/12/84	29.67	2,150	D
AB-95	lat	414749	long	804711	S&G	875	09/12/84	13.51	570	U
AB-96	lat	414750	long	804523	S&G	850	09/12/84	11.55	860	D
AB-97	lat	414752	long	804523	S&G	852	09/12/84	14.17	--	D
AB-98	lat	415322	long	804410	S&G	652	09/12/84	1.29	--	U
AB-99	lat	415234	long	804336	Sh	728	09/12/84	8.00	2,350	D
AB-100	lat	415240	long	804336	S&G	724	09/12/84	2.81	1,150	C
AB-101	lat	415211	long	804446	S&G	740	09/12/84	12.60	--	U
AB-102	lat	415258	long	804517	S&G	653	09/12/84	2.45	--	U
AB-103	lat	415342	long	804308	Sh	662	09/12/84	23.76	--	U
AB-104	lat	415503	long	804319	S&G	634	09/12/84	5.42	910	U



Table 1.--Data for selected wells near Lake Erie, Cleveland to Conneaut, Ohio,  
September 1984--Continued

Local number	Location				Completed in:	Altitude of land surface (feet)	Date of measurement	Water level below land surface (feet)	Specific conductance (µS/cm)	Water use
AB-105	lat	415455	long	804439	S&G	632	09/12/84	6.72	640	D
AB-106	lat	415412	long	804304	S&G	645	09/12/84	4.48	--	D
AB-107	lat	415012	long	804642	S&G	815	09/12/84	26.39	530	U
AB-108	lat	414707	long	805053	S&G	850	09/13/84	64.30	--	U
AB-109	lat	414353	long	805237	Sh	818	09/13/84	15.68	--	D
AB-110	lat	414526	long	805326	S&G	761	09/13/84	9.20	450	D
AB-111	lat	414527	long	805407	Sh	773	09/13/84	24.26	--	D
AB-112	lat	414655	long	805419	S&G	800	09/13/84	11.22	680	D
AB-115	lat	414602	long	805726	Sh	820	09/13/84	33.08	--	D
AB-116	lat	414535	long	805622	S&G	860	09/13/84	5.14	210	U
AB-117	lat	414602	long	805427	S&G	855	09/13/84	81.77	--	C
AB-118	lat	414501	long	805616	S&G	820	09/13/84	15.72	--	D
AB-119	lat	414228	long	805609	Sh	845	09/13/84	37.86	--	D
AB-120	lat	413716	long	805605	Sh	920	09/13/84	9.73	--	D
AB-121	lat	413236	long	805405	S&G	875	09/13/84	26.95	--	D
AB-122	lat	413236	long	805405	Sh	870	09/13/84	50.32	--	D
AB-123	lat	413132	long	805916	S&G	935	09/13/84	6.60	--	D
AB-124S	lat	415040	long	805816	S&G	600	09/19/84	2.20	--	U
AB-124D	lat	415040	long	805816	S&G	600	09/19/84	8.73	--	D
CU-11	lat	413336	long	812427	S&G	691	09/14/84	14.02	--	U
CU-12S	lat	413249	long	812424	S&G	720	09/14/84	7.12	--	U
CU-12D	lat	413249	long	812424	Sh	720	09/14/84	45.09	445	D
CU-13	lat	413145	long	812413	S&G	715	09/14/84	23.04	--	D
CU-14	lat	413122	long	812354	S&G	750	09/14/84	41.44	--	T
CU-15	lat	413115	long	812359	Sh	738	09/14/84	57.68	--	C
CU-16A	lat	413020	long	812413	Sh	798	09/14/84	25.35	--	D
CU-16B	lat	413020	long	812413	Sh	798	09/14/84	25.95	--	D
CU-17	lat	413019	long	812412	Sh	789	09/14/84	7.95	--	U
GE-131	lat	413808	long	811721	S&G	1,015	09/18/84	23.27	--	D
L-11	lat	414730	long	810256	S&G	680	09/11/84	4.37	--	P
L-12	lat	414736	long	810234	S&G	680	09/11/84	7.68	350	P
L-13	lat	414735	long	810235	S&G	680	09/11/84	6.74	--	P
L-14	lat	414734	long	810237	S&G	680	09/11/84	6.49	--	P
L-15	lat	414721	long	810024	S&G	695	09/11/84	14.22	--	D
L-16	lat	414658	long	810512	S&G	690	09/11/84	7.77	290	D
L-17	lat	414753	long	810436	S&G	675	09/11/84	17.95	--	I
L-18	lat	414811	long	810245	S&G	670	09/11/84	8.70	--	U
L-19	lat	414910	long	810119	Sh	630	09/11/84	4.86	410	D
L-20	lat	414916	long	810520	S&G	630	09/11/84	31.11	540	D
L-21	lat	414450	long	810349	S&G	840	09/11/84	45.95	--	D
L-22	lat	414447	long	810348	S&G	830	09/11/84	20.29	1,800	D
L-23	lat	414334	long	810234	Sh	900	09/11/84	21.50	--	T
L-24	lat	414321	long	810432	S&G	910	09/11/84	2.15	910	U
L-25	lat	414321	long	810432	S&G	930	09/11/84	8.66	--	D
L-26	lat	414424	long	810112	S&G	805	09/11/84	9.65	--	D
L-27	lat	414844	long	810601	S&G	625	09/12/84	8.63	760	D
L-28	lat	414829	long	810723	S&G	625	09/12/84	11.70	160	D
L-29	lat	414656	long	810725	S&G	685	09/12/84	16.14	650	D
L-30	lat	414618	long	810936	S&G	685	09/12/84	12.70	430	D
L-31	lat	414553	long	810936	S&G	695	09/12/84	6.17	1,120	D

Table 1.--Data for selected wells near Lake Erie, Cleveland to Conneaut, Ohio,  
September 1984--Continued

Local number	Location			Completed in:	Altitude of land surface (feet)	Date of measurement	Water level below land surface (feet)	Specific conductance (µS/cm)	Water use	
L-32	lat	414723	long	810939	S&G	615	09/12/84	12.48	2,900	D
L-33	lat	414718	long	810938	S&G	625	09/12/84	11.09	800	U
L-34	lat	414247	long	811111	Sh	790	09/12/84	61.32	--	U
L-35	lat	414349	long	810938	Sh	820	09/12/84	57.10	--	D
L-36	lat	414421	long	810717	Sh	840	09/12/84	68.10	--	U
L-37	lat	414528	long	810612	Sh	730	09/12/84	8.65	650	U
L-38	lat	414548	long	810724	Sh	705	09/12/84	7.87	--	D
L-39	lat	414322	long	810731	Sh	840	09/12/84	18.36	840	D
L-40	lat	414203	long	810848	S&G	965	09/12/84	15.69	--	D
L-41	lat	414303	long	811039	S&G	735	09/12/84	3.05	1,100	D
L-42	lat	414302	long	811038	Sh	750	09/12/84	16.70	--	D
L-43	lat	414019	long	810923	S&G	1,005	09/12/84	3.01	--	D
L-44	lat	413948	long	810905	S&G	1,060	09/12/84	3.83	--	D
L-45	lat	414111	long	810626	Sh	1,035	09/12/84	15.89	--	D
L-46	lat	414524	long	811114	S&G	688	09/13/84	6.36	--	C
L-47	lat	413914	long	811916	S&G	772	09/13/84	65.80	--	T
L-48	lat	414129	long	811753	S&G	688	09/13/84	28.65	--	D
L-49	lat	414314	long	811900	S&G	627	09/13/84	9.59	--	U
L-50	lat	414306	long	811913	S&G	627	09/13/84	9.41	--	U
L-51	lat	414014	long	812437	S&G	617	09/13/84	27.05	--	U
L-52	lat	414012	long	812438	Sh	592	09/13/84	2.01	--	U
L-53	lat	414127	long	812420	S&G	612	09/13/84	1.90	--	U
L-54	lat	414045	long	812304	S&G	625	09/13/84	5.47	--	D
L-55	lat	414153	long	812334	S&G	609	09/13/84	4.27	--	U
L-56S	lat	413726	long	812342	S&G	615	09/13/84	3.76	--	U
L-56D	lat	413726	long	812342	S&G	615	09/13/84	5.79	--	U
L-57	lat	413659	long	812408	S&G	636	09/13/84	2.55	--	U
L-58	lat	413643	long	812515	S&G	765	09/13/84	16.15	--	U
L-59	lat	413629	long	812006	Sh	690	09/14/84	21.59	--	D
L-60	lat	413535	long	811913	S&G	1,065	09/14/84	62.48	--	D
L-61	lat	413435	long	812110	S&G	1,085	09/14/84	99.78	--	D
L-62	lat	414216	long	811332	S&G	615	09/14/84	6.24	--	U
L-63	lat	413839	long	811424	Sh	995	09/14/84	8.14	--	D
L-64	lat	414204	long	811511	S&G	710	09/14/84	5.14	--	U
L-65	lat	413755	long	811835	S&G	715	09/14/84	6.33	--	D
L-66	lat	413620	long	812412	S&G	629	09/14/84	3.39	--	U
L-67	lat	413551	long	812315	S&G	661	09/14/84	6.28	--	U
L-68	lat	413512	long	812051	S&G	1,065	09/18/84	2.01	--	Z
L-69	lat	413549	long	811758	S&G	1,120	09/18/84	71.42	--	D
L-70	lat	413643	long	811729	S&G	1,000	09/18/84	2.85	--	P
L-71	lat	414059	long	811829	S&G	681	09/18/84	10.59	--	Z
L-72	lat	413921	long	811555	S&G	925	09/18/84	31.80	--	D
L-73D	lat	414037	long	811519	Sh	767	09/18/84	48.43	1,300	D
L-73S	lat	414037	long	811519	S&G	767	09/18/84	3.72	410	U
L-74	lat	414039	long	811519	S&G	773	09/18/84	7.80	--	U
L-75	lat	414339	long	811316	S&G	690	09/19/84	8.38	--	U
L-76	lat	414344	long	811318	S&G	689	09/19/84	6.08	--	U
L-77	lat	414356	long	811716	S&G	595	09/18/84	1.82	--	U
L-78	lat	414638	long	811152	S&G	620	09/18/84	1.72	--	U
L-79	lat	414637	long	811142	S&G	624	09/18/84	4.39	--	U

Table 1.--Data for selected wells near Lake Erie, Cleveland to Conneaut, Ohio,  
September 1984--Continued

Local number	Location			Com- pleted in:	Alti- tude of land surface (feet)	Date of measure- ment	Water level below land surface (feet)	Spe- cific conduc- tance ( $\mu$ S/cm)	Water use
L-80	lat 414623	long 811128	S&G		631	09/18/84	2.85	--	U
L-81	lat 414622	long 811133	S&G		630	09/18/84	9.66	--	U
L-82	lat 414636	long 811139	S&G		626	09/18/84	2.79	--	U
L-83	lat 414644	long 811136	S&G		615	09/18/84	3.28	--	U
L-84	lat 414647	long 811139	S&G		621	09/18/84	4.50	--	U
L-85D	lat 414627	long 805941	S&G		760	09/13/84	31.26	--	D
L-85S	lat 414627	long 805941	S&G		760	09/13/84	2.00	--	U